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BACHELOR THESIS

"Conditional Convergence of ASEAN Countries"

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Abstract

This bachelor thesis aims to examine the economic growth in ASEAN countries. The long-run economic growth allows counties or region to improve GDP per capita, living conditions as well as reduce poverty. The Solow growth model suggests convergence of different countries to converge into a steady state over time. The following sections will be based on conditional convergence between five chosen countries in South East Asia with similar characteristics.

1. Introduction

Since the beginning of 1950s, there has been many developments of economic growth theories. Large economies such as the European Union, United States of America and members of OECD (The Organization of Economic Co-operation and Development) have shown great economic improvements since post-World War II. These economic communities have been working together to create and develop technology and human capital, which have great influence on growth. With high quality of human capital comes better research and development plans and more stability in both economically and politically. On the other hand, Asian countries, especially South East Asia, are rich with natural resources. Countries in this region have not had much growth compared to bigger economies. Natural resources alone does not allow countries to advance in living standards or higher productivity. The lack of skilled workers have been holding South East Asian countries back from competing with greater economies in the West. In order to step up to world great economies, South East Asia has formed an economic community called ASEAN which will allow member states to assist each other to grow beyond the current state.

The two main types of economic growth theories will be briefly explained in the following section to give some basic ideas of how growth can be achieved. The well-known theory of Solow (1956) have encouraged other economist of that time to be critical and thus bring in new ideas of how economic growth actually occurs. Therefore, another model of Lucas (1988) will explain the importance of human capital that was not the main focus of Solow model.

This paper will be examining conditional convergence among South East Asian countries. The focused countries are part of the Association of Southeast Asian Nations. Their goals and vision will be stated to show the importance of ASEAN in developing nations.

Once the conditional convergence is defined, the linear regression will be examine. The outputs of SPSS Program will allow us to access whether such countries are converging into a steady state and at what rate. The beta-values as well as significance levels from the SPSS output will be observed to determine such state.

2. Economic Growth

Economic growth is an important topic in macroeconomics. It explains the historical and predicts the future trend of economies in different countries or continents. The long-run economic growth of real GDP per capita, adjusted for inflation and population, is believed to increase welfare in a country or region. There are many benefits of economic growth including but not limited to supporting a larger population, greater life expectancy, increasing income and reductions in poverty (Miles, Scott & Breedon, 2014). Economic growth can be divided into two main categories; exogenous growth and endogenous growth.

The growth theory started off with the Solow (1956) where he stated that the standard neoclassical production function has a decreasing marginal of capital and labor. The effects of saving rate and population growth on level of income per capita are exogenous (Mankiw, Romer & Weil, 1990). Solow model assumes a Cobb-Douglas production function, shows in equation (1.1). By taking a derivative of Y with respect to K and L, we can see that there is diminishing marginal product of both capital and labor. This implies that the higher the capital stock (machines), the lower the marginal product of capital (Colander&Gamber, 2006). The notation in (1.1) are A is total factor productivity (technology), K is capital and L is labor. The model is under assumptions that labor input only considers the employed in the labor force, growth rate of labor is equal to population growth rate, effects of government activities are to be ignored and there is a closed economy (Barro, 2008).

$$Y = A \cdot K^{\alpha} \cdot L^{1-\alpha} \quad ; \quad 0 < \propto < 1 \tag{1.1}$$

As A and L are assumed to be exogenous, the level of labor is fixed. This leaves the (1) as a function of capital, K. With this in mind, the steady state is where investment is equal to the depreciation rate; where (1.2) = (1.3). Therefore, once a country reaches its steady state, the only solution for growth is to increase the TFP.

$$D(t) = d \cdot K \tag{1.2}$$

$$I(t) = s \cdot Y \tag{1.3}$$

Contradicting to Solow model of diminishing marginal product of capital, Lucas (1988) sees human capital as a more important factor for economic growth which leads to an endogenous growth model instead of an exogenous one. He argues that even though there is a diminishing marginal product of physical capital when human capital is held constant, the returns to human plus physical capital are constant (Mankiw, Romer & Weil, 1990). Once there is a constant MPK, there can be no convergence to a steady state because there is no steady state. Investment is now always greater than the depreciation rate. The country that saves more, invest more and therefore grow faster indefinitely. The production function with human capital is defined as:

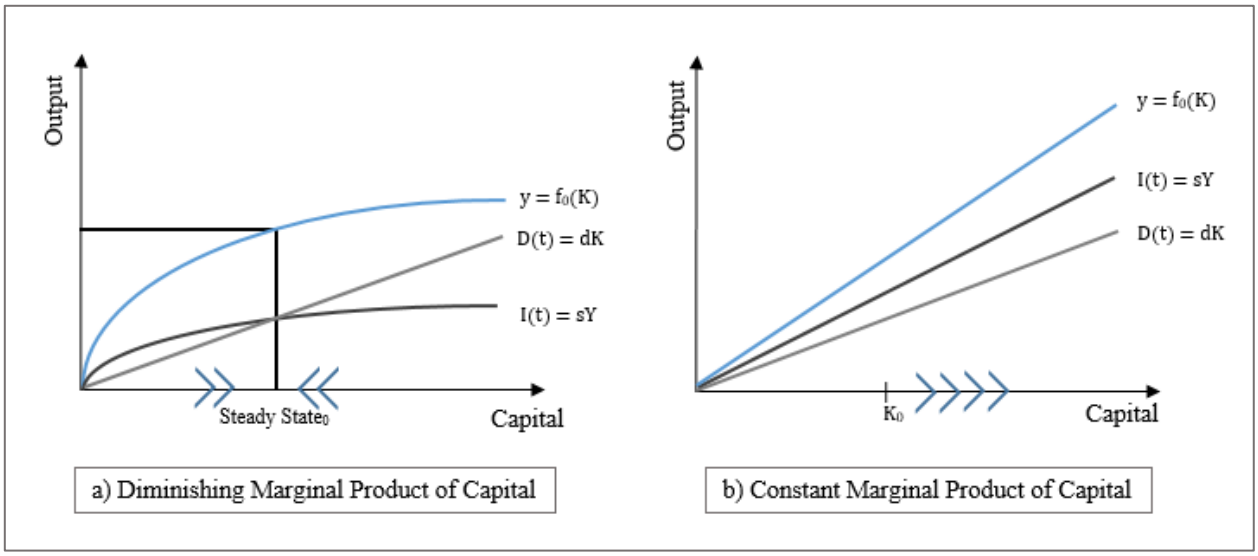
$$Y(t) = A \cdot K^{\alpha} \cdot H^{\beta} \cdot L^{1-\alpha-\beta} \tag{1.4}$$

"Human capital is the accumulation of time spent in schooling and training" (Grossman&Helpman, 1993, p. 19). Even though an individual's human capital cannot grow indefinitely, the skills acquired by each can be used to further improve technology. This will result in a continuous increase in the value of human capital. With more advance technologies, an economy can increase production, thus leading to growth. Growth however does not rely on the size of labor force. An economy with more labor does not always result in economic growth. This depends on how skilled or unskilled the labor force is. A larger economy with more unskilled labor may not grow as fast as a smaller economy with more skilled labor. This is because the human capital has higher value and so they are able to conduct better R&D and implement it into the economy.

Fig. 1.1 below distinguishes the production function of diminishing and constant marginal product of capital. The graph a) shows how countries would increase or decrease their capital accumulation to converge to their steady state. The graph b) however displays how there is no intersection between investment and depreciation rate. As human capital increases, physical capital increases

leading to a more productive economy. The process continues, thus there is no convergence of countries.

Figure 1.2.1 Diminishing vs. Constant MPK



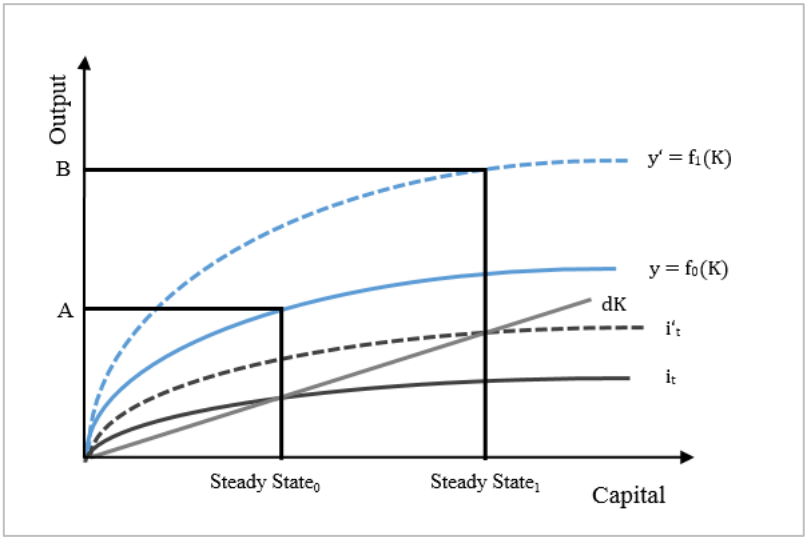
This paper will base on exogenous growth with diminishing marginal product of capital. The following section will explain in more detail about how economic convergence can occur.

2.1 Economic Convergence

Economic convergence is commonly known as the catching-up effect. The neoclassical form of production function according to Solow-Swan model (1956) explains how countries can converge into a steady state in the long-run. The diminishing marginal product of capital predicts this process. The model predicts that, "the lower the starting GDP per capita, relative to the long-run or steady state position, the faster the growth rate." (Barro & Sala-i-Martin, 2004). The smaller economies will grow easier and faster through only some increase in investment, whereas it is harder for the bigger economies due to the effect of diminishing marginal product of capital. The same increase in investment allows poorer countries to grow faster, thus catching up to the

wealthier countries. This presents one type of economic convergence, namely, absolute convergence. It is when the catching-up effect occurs and all economies are predicted to converge into one steady state, regardless of their initial economic conditions (Wane, 2004). As economies converge, they will eventually stop growing. Therefore, in order to sustain positive growth rate in the long-run, countries require a technological progress (Mathur, 2007). As seen in Fig.1.2, the increase technological progress shifts the production function upwards which leads to higher investment. This shift in TFP increases output from A to B and move the steady state from steady state$_0$ to steady state$_1$. This process will occur continuously thus leading to economic growth, as long as there is a continual advance in technology.

Figure 1.2.2 Shift in TFP



2.2 Conditional Convergence

While absolute or unconditional convergence searches for a convergence of different countries to a steady state regardless of their economic conditions, conditional convergence takes into account other factors. Conditional convergence not only observe the initial GDP and the growth rate, but it also includes other elements in the economy that have effects on such long-run growth. In absolute

convergence, poor countries that starts with a lower GDP tends to have higher growth rate than richer countries which is determined by the diminishing marginal product of capital. In conditional convergence, countries are broken down into different regions and common characteristics. Rich and poor countries are suggested to have different structural characteristics which influence the growth in different regions distinctively (Pearce&Barbier, 2000). The different factors that are taken into consideration when searching for conditional convergence are typically investment, education, trade openness and technology (Wolff, 2014). Within each group of similarities, the effect of relatively poorer countries growing faster than the richer countries still applies. The common examples of such groups that has similar characteristics and show a strong evidence for conditional convergence are the US states, European regions as well as OECD economics (Tumpel-Gugerell&Mosslechner, 2003). Each region would share the same steady state in which countries within that group converge to; the above mentioned factors would determine this steady state.

There are two types of convergence model that can determine conditional convergence; δ-convergence and β-convergence (Lei&Yao, 2009). This paper will be based on β-convergence model. The β-convergence refers to the negative correlation between initial level of GDP per capital and average yearly growth rate. The equation (1) shows the regression model. The dependent variable is the growth rate of log(GDP) of every year. The right side of the equation composes of *i*) μ, constant of the regression of each country. *ii*) X_i, variables which determines the differences between regions (Alexiadis, 2013).

$$\Delta Y_t = \mu + \beta Y_{t-1} + b_2 X_1 + b_3 X_2 + b_4 X_3 + b_5 X_4 \quad (1)$$

This paper will base on equation (1) and the variables are investment, education, health and technology. The Y_t will be the log(GDP) of each year for every country and ΔY_t is the differences between Y_t and Y_{t-1}.

3. ASEAN

The Association of Southeast Asian Nations was established in 1967 in Bangkok, Thailand with the signing of ASEAN Declaration by Indonesia, Malaysia, Philippines, Singapore and Thailand. The other members who joined later, includes Brunei Darussalam, Viet Nam, Lao PDR, Myanmar and Cambodia. The fundamental principles of ASEAM Member States are to not only have 'mutual respect of independence, sovereignty, equality, territorial integrity and national identity of all nations' (www.asean.org) but also to have non-interference in the internal affairs as well as cooperation among themselves.

The main aims and purposes of ASEAN Declaration includes;

- To accelerate the economic growth, social progress and cultural development
- To promote regional peace and stability
- To provide assistance in form of training and research facilities in different aspects of country development
- Raising the standards of living of local peoples
- For beneficial cooperation among members with similar aims and purposes

ASEAN is divided into three main communities; Political-Security Community, Economic Community and Socio-Cultural Community. The Political-Security Community or APSC tries to ensure peace, just, harmonious and democratic environment between state members. Its vision is to prevent conflicts, but when necessary, resolve conflict, build peace post-conflict and implement mechanisms. THE APSC aims to create an integrated and interdependent world with a dynamic and outward-looking mindset. The Economic Community or AEC was the third largest economy in Asia and the seventh largest in the world in 2014 with a combined GDP of US$2.6 trillion (The ASEAN Secretariat, 2015). Its framework is to operate as an economic community, responding to new developments and seizing new opportunities. The Socio-Cultural Community or ASCC focuses to nurturing the human, cultural and natural resources in order to sustain development in ASEAN. It aims to build a common identity and a caring and sharing society. This includes the well-being, livelihood and welfare of people in the state members. (www.asean.org)

This paper and the data sets collected are based on the ASEAN Economic Community. The following section will explain in more detail about the AEC as well as why it is chosen to be in part of the conditional convergence test.

3.1 ASEAN Economic Community

Like any other economic community, AEC has visions to develop and build a better and greater economy within the region. With cooperation of the members, ASEAN will be able to face global economic shocks and volatilities with the maximum insurance. The increase in the GDP per capita is not the only aim in the AEC blueprint of 2025, but it consists of many other factors that will help sustain such great economy to in the near future. Other than economic growth in ASEAN, AEC aims to reduce poverty and maintain a rising middle class.

Economic growth is highly related to productivity growth, therefore, AEC has foreseen the need to develop through innovation, technology and human resource development. This can be achieved by intensifying regional research with the increasing number of research facilities in the area. The advance in research can lead to higher technology and a more knowledge-intensive in manufacturing and services industries, thus increasing productivity.

Political factors also have great impacts on the economy and how a country handles uncertainties. Therefore, AEC promotes the principles of good governance and transparency. These principles will enhance the development of competition policy, consumer protection, intellectual property rights, narrowing the development gap as well as reinforcing ASEAN's relationship with external parties (The ASEAN Secretariat, 2015).

For the purpose of running regression to investigate if there is any evidence of conditional convergence, five out of ten state members have been chosen. The big five, which are also the founding countries of ASEAN are chosen; Indonesia, Malaysia, Philippines, Singapore and Thailand. These members have the top 5 GDP per capita among other nations (Hansakul&Keng 2013) and they are assumed to share similar economic structure and characteristics. Therefore, they are good candidates for this paper.

3.2 ASEAN Economic Performance between 1990-2012

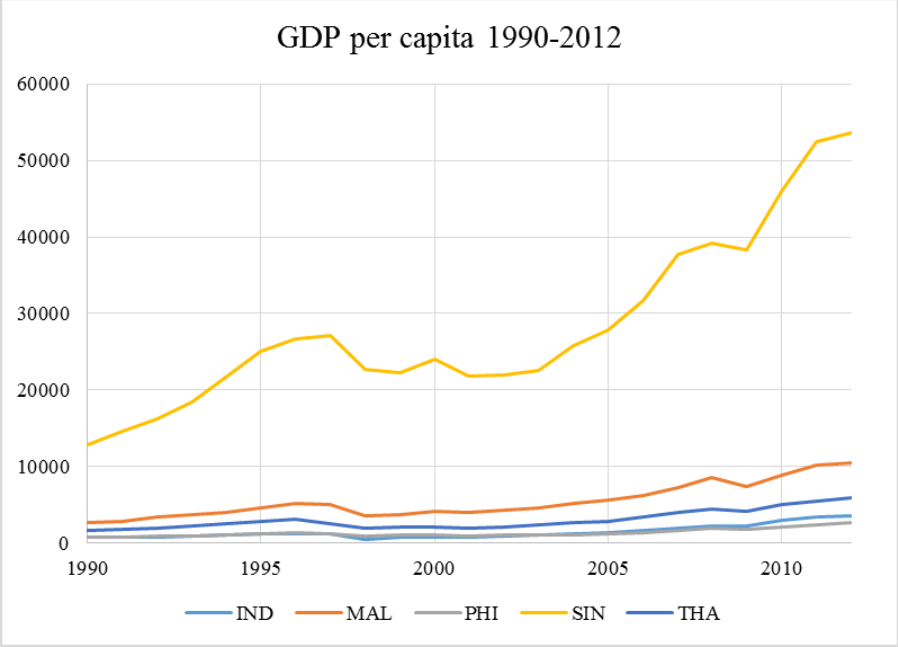
For the past two decades, ASEAN countries have been improving and making progresses with economy structure and social standards. In the late 1980s to early 1990s, as known as the 'golden decade', ASEAN's growth rate has soared greatly almost doubling within a decade. However, an unfortunate event occurred in 1997, which crashed ASEAN GDP per capita. The financial crisis in 1997 had an effect on all the ASEAN nations. The Fig. 3.1 shows the decline in GDP for all top five ASEAN countries in 1997.

The golden decade did not last for long, as on July 2nd 1997, Thai baht devalues greatly causing Thai economy to crash. The value of Thai baht dropped 20%, which calls for help from the IMF (WGBH educational foundation, 2014). The crisis has been building up since the early 1990s where the Thai government imposed a fixed exchange rates between Thai baht and world dominant currencies of US dollars. The stability and high interest rate of 13.25% (Laplamwanit, 1999) attracted foreign investors. Some of the international speculators took risks of retrieving their investments from Japan and reinvesting in Thailand for higher interest rates. Both domestic investment and banking sector expanded rapidly before the crisis. The high domestic interest rate encouraged these sectors to borrow offshore. However, in the late 1990s, the US increased interest rates which caused it to be less attractive to invest in Asian countries. The Thai government could not sustain their fixed exchange rates against US dollars. This forces the Thai government to float Thai baht. Later on, the currency had to be devalued because the 'investors wanted to get out of Asian currencies.' (Pettinger, 2012). The devaluation led to the impossible high debt, therefore, it was much more difficult to repay the foreign lenders and led to many business bankruptcies. Thai baht devaluation caused a spiral effect which firstly hit Southeast Asian countries, and later on, on to South Korea, Indonesia, and into a much bigger scale (The Economist, 2007).

The economies started to recover during 2001-2007. The economic transformation of ASEAN allowed each nations to capture different economic opportunities to recuperate their GDP growth. For instance, Malaysia benefited from Chinese commodities boom which drove their palm oil to dominate the agriculture sector. Indonesia had an industrial expansion because they had a big domestic market. Thailand became the 'hub of production networks' in automotive manufacturing and logistics for neighboring countries. The Philippines and Singapore are the only members that

their services account for more than half of their GDP. Singapore provide highly skilled labor in return for high wages. The Philippines was focusing mainly on the outsourced business processes which significantly increased their percentage of services sector to GDP.

Figure 3.1 GDP growth between 1990-2012 : Top 5 ASEAN Countries



Source: UNESCAP Statistics Database, 2015

Not long after the recovering phrase from the 1997-98 crisis, the ASEAN economies were hit once again by the global financial crisis in 2007-08. The crisis was triggered by the overvaluation of mortgages in the US, which led to 'housing bubble' that eventually causes the real estate price to plummet. Another major effect on the global economy is the bank solvency which was a consequence of declines in credit availability as well as decrease of investors' confidence. This had an impact on global stock markets (IMF, 2009). As most ASEAN members rely greatly on exporting to the West, the economies were effected but rather in a mild magnitude (Ramayandi, 2011). The Fig. 3.1 shows a small dip during this period, but not as significant as the financial crisis in 1997-98.

4. Hypothesis

Countries in the ASEAN community are assumed to share some similarities. In order to examine if these five chosen countries are converging into their own steady state, equation (4) will be utilized. Equation (4) is derived from the growth model of:

$$\Delta y_t = \mu + \beta(y_{t-1} - \bar{y}_{t-1}) \quad (2)$$

; where: $y_t = \log(GDP)$ is the real GDP (2.1)

$\Delta y_t = y_t - y_{t-1}$ is the growth rate (2.2)

$\bar{y}_{t-1}$ is the potential output (2.3)

The steady state GDP is influence by various factors. This bachelor thesis concentrates of four factors, which forms a steady state GDP such that:

$$\bar{y}_t = (a_1 \times Investment) + (a_2 \times Education) + (a_3 \times Health) + (a_4 \times Technology) \quad (3)$$

Finally, equation (3) is plugged into equation (2) to get equation (4).

The F-Test checks if there is a true relationship between at least one independent variable and the dependent variable. The t-Test hypothesis will be observed, where, if significant level is less than 0.05 (confidence interval 95%), then H_0 is to be rejected. This implies that there is a linear relationship between a certain explanatory variable and the dependent variable.

H_0: $\beta = 0$

H_1: $\beta \neq 0$

The equation (4) will be run for every country. If there is conditional convergence among these five countries, the regression output of each country must show a negative and significant (p-value < 0.05) β as well as $c_i \neq 0$.

$$\Delta Y_t = \mu + \beta Y_{t-1} + c_2 Investment + c_3 Education + c_4 Health + c_5 Technology \quad (4)$$

If all β values are negative and significant for all countries, we can conclude that there is an evidence of conditional convergence among top five countries in ASEAN Economic Community into their own steady state.

5. Method & Data Input

The historical data sets are collected from UNESCAP (United Nations; Economic and Social Commission for Asia and the Pacific) statistics database (http://www.unescap.org). The data ranges from 1990 – 2012, in total of 23 data points for each category of each country. The collected data, however, were not complete, where data in between years were missing. For this reason, the data sets needed to be extrapolated.

The collected data for variables are in percentage of GDP;

Investment: Gross domestic investment rate in current prices.
(Data obtained on 15 January 2015)

Education: Public expenditure on education.
(Data obtained on 25 June 2014)

Health: Total health expenditure.
(Data obtained on 6 August 2014)

Technology: Gross domestic expenditure on research and development.
(Data obtained on 1 December 2014)

Gross domestic product: expressed in the current prices of US dollars per capita

(Data obtained on 13 January 2015)

After the data collection process, data are sorted out into countries. GDP is calculated into log(GDP) and the growth rate is calculated by taking the difference between $\log(GDP)_1$ and $\log(GDP)_2$ and so on for all the years.

The regression is done with the SPSS program, where regression of each country is run separately. The linear regression has growth rates as dependent variable and all other the variables as independent variables. The regression is regressing the growth rate of GDP on log(GDP) of previous year. The output includes the descriptive statistics, correlation, model summary with Durbin-Watson analysis, ANOVA and coefficients tables. The confidence interval is at the level of 95%. The μ, β and b_i values are read from the coefficients table. If the β value of log(GDP) is negative and p-value is less than 0.05, then that specific country shows a sign of conditional convergence.

6. Estimation Output

The following sections shows and describes the output from running the regression in SPSS. The total number of observations for each variable and each country is 22. For further detail, each country's complete output can be found in the Appendix.

6.1 Indonesia

As seen in the coefficient table, health has a positive and significant (p-value = 0.007 at the 0.05 significance level) influence on the growth rate of GDP for Indonesia. The regressor log(GDP) shows a negative and significant value of -0.586 (p-value = 0.027). The other independent variables except for education have positive influence on growth. However, these variables have p-values greater than 0.05, therefore, they do not have the explanatory power.

From the output, the regression equation can be formed as:

$$\Delta Y_t = \underset{}{0.731} - \underset{(0.240)}{0.586}\log(GDP) + \underset{(0.104)}{0.332}hlth + \underset{(0.006)}{0.004}invt + \underset{(0.389)}{0.504}\,r\&d - \underset{(0.034)}{0.035}edu$$

Table 6.1 Indonesia Coefficients Table

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	.731	.408		1.791	.092
Health	.322	.104	1.334	3.093	.007
Investment	.004	.006	.202	.640	.531
R&D	.504	.389	.387	1.297	.213
Education	-.035	.034	-.343	-1.036	.316
Log(GDP)	-.586	.240	-1.303	-2.442	.027

6.2 Malaysia

The regression output for Malaysia shows that only education has an impact on the growth rate of Malaysia's GDP per capita. Its p-value is 0.036 which is considered statistically significant. The rest of the p-values are greater than 0.05, therefore we cannot conclude that there is a linear relationship between $c_2 - c_4$ and the growth rate. Nonetheless the important factor of β of log(GDP) has a negative value of -0.348 with p-value of 0.037. This shows that there is a sign that there could be conditional convergence.

The regression equation for Malaysia is:

$$\Delta Y_t = \underset{}{1.151} - \underset{(0.153)}{0.348}\log(GDP) + \underset{(0.052)}{0.084}hlth - \underset{(0.002)}{0.001}invt + \underset{(0.150)}{0.089}\,r\&d - \underset{(0.011)}{0.026}edu$$

Table 6.2 Malaysia Coefficients Table

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.151	.580		1.985	.065
Health	.084	.042	.666	1.619	.125
Investment	-.001	.002	-.101	-.273	.789
R&D	.089	.150	.491	.590	.563
Education	-.026	.011	-.528	-2.294	.036
Log(GDP)	-.348	.153	-1.061	-2.280	.037

6.3 Philippines

Unfortunately the output for the Philippines does not suggest that any of the independent variables have a linear relationship with the dependent variable. Even though the value of log(GDP) is negative, its p-value is 0.149, which is greater than 0.05. Therefore, we cannot conclude that the Philippines is showing any sign of conditional convergence towards its steady state.

The regression equation is:

$$\Delta Y_t = \underset{}{0.687} - \underset{(0.157)}{0.239}\log(GDP) + \underset{(0.057)}{0.074}hlth + \underset{(0.003)}{0.000}invt + \underset{(2.492)}{0.107}\, r\&d - \underset{(0.051)}{0.066}edu$$

Table 6.3 Philippines Coefficients Table

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	.687	.582		1.181	.255
Health	.074	.057	.757	1.305	.210
Investment	.000	.003	-.015	-.057	.955
R&D	.107	2.492	-.034	.043	.966
Education	-.066	.051	-.549	-1.300	.212
Log(GDP)	-.239	.157	-.728	-1.516	.149

6.4 Singapore

The value of log(GDP) is negative (-0.172) and the p-value is 0.023 which gives us a hint of Singapore's conditional convergence. Other independent variables have slightly higher p-value than 0.05, so they are not statistically significant to conclude any linear relationship with the dependent variable.

The regression equation is:

$$\Delta Y_t = \underset{}{0.956} - \underset{(0.069)}{0.172}\log(GDP) + \underset{(0.025)}{0.052}hlth - \underset{(0.003)}{0.005}invt - \underset{(0.029)}{0.059}\,r\&d - \underset{(0.038)}{0.026}edu$$

Table 6.4 Singapore Coefficients Table

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	.956	.326		2.928	.010
Health	.052	.025	.732	2.112	.051
Investment	-.005	.003	-.793	-1.978	.065
R&D	-.059	.029	-.638	-2.048	.057
Education	-.026	.038	-.191	-.677	.508
Log(GDP)	-.172	.069	-.670	-2.509	.023

6.5 Thailand

Thailand's log(GDP) has a positive β value of 0.112 and its p-value is as high as 0.347. The rest of the independent variables also show high p-values and therefore they are not significant to the dependent variable. There is no evidence that Thailand is facing conditional convergence.

The regression equation is:

$$\Delta Y_t = \underset{}{0.293} + \underset{(0.116)}{0.112}\log(GDP) - \underset{(0.074)}{0.120}hlth - \underset{(0.003)}{0.003}invt + \underset{(0.418)}{0.101}\,r\&d - \underset{(0.019)}{0.035}edu$$

Table 6.5 Thailand Coefficients Table

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	t	Sig.
1 (Constant)	.293	.267		1.098	.288
Health	-.120	.074	-.579	-1.629	.123
Investment	-.003	.003	-.513	-.934	.364
R&D	.101	.418	-133	.243	.811
Education	-.035	.019	-.539	-1.831	.086
Log(GDP)	.112	.116	.340	.970	.347

7. Findings

After running the regression in SPSS to examine the steady states, the results are in conclusive. Three out of five countries, Indonesia, Malaysia and Singapore are the countries which show negative β values with statistically significant p-value (< 0.05). The other two countries do not have significant value of β. However, the Philippines shows a negative value. From these results, it showed that four out of five countries have negative β values which are weak indicators of conditional convergence. The p-value that raises the question of whether the value is significant or not, may be due to low number of observations. As each regression only consists of 22 observations for each variable, this may be the reason that the output could not show significant results as it is not as precise as it should be. Nevertheless, the negative values of four countries give some hints of conditional convergence for some ASEAN countries.

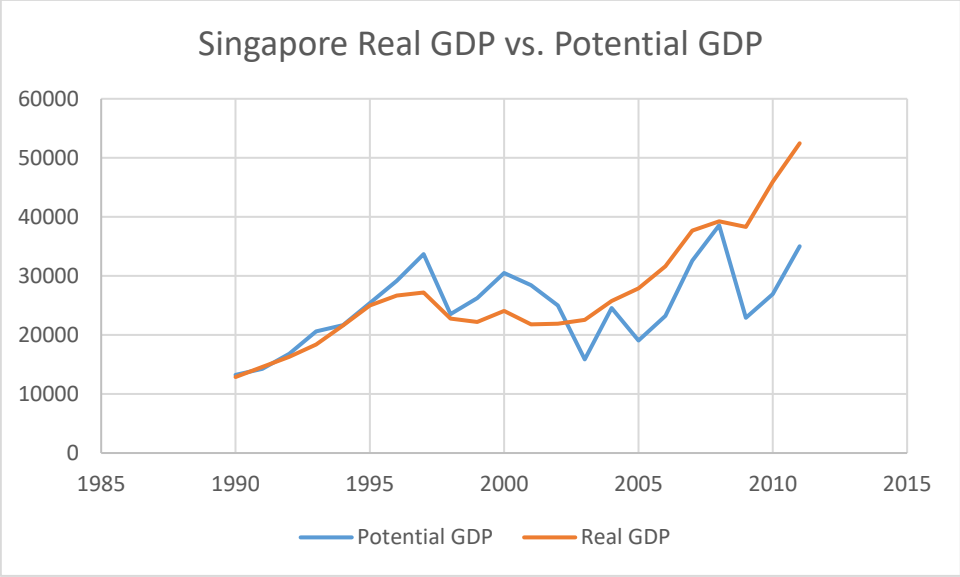
In order to examine more accurate outcomes, there must be a bigger data set. This can be done with longer period or higher frequency of data; quarterly data instead of yearly. Other factors may also need to be taken into account. The variables used in this paper are only the main indicators, but to be more specific on the economic structure of each countries, other factors such as political or trade information need to be included.

To evaluate the result further, countries that showed statistically significant β values are plotted on graphs. Each graphs are shows the Real GDP vs. Potential GDP which is obtained from the regression results. The independent values are divided by the β value of that country for the period of 1990-2012 to obtain the a values in equation (3). All the a values are summed up and multiplied

by the real GDP to result in potential GDP. Once there is Real GDP and Potential GDP, the data is plotted with Years on the x-axis and GDP on the y-axis.

The Fig. 7.1 shows the graph for Singapore. It shows that the real GDP and potential GDP are moving the same direction. In around the year 2002, the graph shows that the real GDP is increasing much more than its potential GDP. Overall, the analysis of Singapore gives some hints of its conditional convergence into its steady state.

Figure 7.1 Singapore Real GDP vs. Potential GDP



Unlike Singapore, Indonesia and Malaysia plot of real GDP vs. potential GDP (Fig. 7.2 and Fig. 7.3) does not show positive correlation. For both of these countries, the real GDP line is diverging away from the potential GDP line. This cone shape hints us that there might not be any conditional convergence in these countries, regardless of their regression equations.

8. Conclusion

Economic growth is one of the most important goals for any economy. The more an economy grows, the more it is able to maintain and further develop level of living standards, decrease uncertainty as well as decreasing poverty. The long-run economic growth allows a country, region or continent to go beyond their current capacity, thus increasing production and income per capita.

The two main theories of long-run economic growth concentrate on different aspects. The Solow model of diminishing marginal product of capital convinces us that in the long-run, countries would either increase or decrease their accumulation of capital to converge into a steady state. However, the Lucas model includes human capital as a very important factor in economic growth. He suggests that the production is not diminishing, but instead has constant marginal product of capital. With this constant MPK, there will be on convergence among countries. The higher the capital stock, the higher the production, and therefore a country or region would grow in definitely. This paper has been based on the Solow diminishing MPK, but not the absolute convergence, but conditional convergence between countries with similar characteristics. The chosen countries are in the same region of ASEAN.

ASEAN, the abbreviation for Association of Southeast Asian Nations was established 1967. Its main purpose to is provide assistance to each other, encourage each nations to further develop their living standards, and most importantly, to accelerate economic growth. The association is divided into to three communities and this paper have focused on the AEC, the economic community. The chosen five countries are the founding members and ones with the top five GDP per capita.

The outcome of the regression of five countries to examine and search for any evidence of conditional convergence was inconclusive. The important reason to bear in mind is the size of each data sets. Each data sets contained 22 observations and this might have caused the regression results to be statistically significant. Even though most of the independent variables were not significant, the two countries that show a positive result allow us to be skeptical about it. The overall result does not show some evidence of conditional convergence, but results of Indonesia and Malaysia with negative and significant β value hints us that there is a possibility that there is such convergence among ASEAN countries.

In order to get more accurate results, the regression has to be run with more variables with more observations for each. The conclusion of this paper shows that with more specific and detailed data, it is likely that there will be evidence of conditional convergence.

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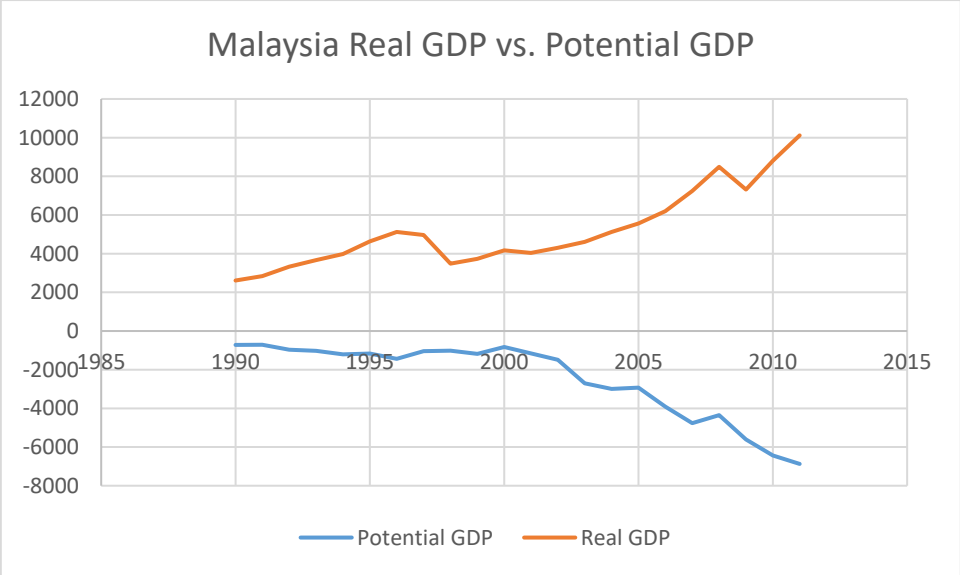
Appendix

Figure 0.2 Indonesia Real GDP vs. Potential GDP

Figure 0.3 Malaysia Real GDP vs. Potential GDP



Indonesia

Anmerkungen

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Deskriptive Statistiken

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deltay	,0322	,09692	22
health	2,3545	,40205	22
investment	25,6864	5,35460	22
rd	,6432	,07448	22
education	2,1932	,93685	22
loggdp	3,0666	,21556	22

Korrelationen

		deltay	health	investment	rd	education	loggdp
Korrelation nach Pearson	deltay	1,000	,323	-,203	,122	,156	-,045
	health	,323	1,000	,185	,633	,798	,783
	investment	-,203	,185	1,000	,421	,020	,619
	rd	,122	,633	,421	1,000	,576	,766
	education	,156	,798	,020	,576	1,000	,609
	loggdp	-,045	,783	,619	,766	,609	1,000
Sig. (1-seitig)	deltay	.	,071	,183	,295	,244	,422
	health	,071	.	,205	,001	,000	,000
	investment	,183	,205	.	,026	,464	,001
	rd	,295	,001	,026	.	,003	,000
	education	,244	,000	,464	,003	.	,001
	loggdp	,422	,000	,001	,000	,001	.
N	deltay	22	22	22	22	22	22
	health	22	22	22	22	22	22
	investment	22	22	22	22	22	22
	rd	22	22	22	22	22	22
	education	22	22	22	22	22	22
	loggdp	22	22	22	22	22	22

Aufgenommene/Entfernte Variablen[a]

Modell	Aufgenommene Variablen	Entfernte Variablen	Methode
1	loggdp, education, investment, rd, health[b]	.	Einschluß

a. Abhängige Variable: deltay

b. Alle gewünschten Variablen wurden eingegeben.

Modellzusammenfassung

Modell	R	R-Quadrat	Korrigiertes R-Quadrat	Standardfehler des Schätzers
1	,664[a]	,441	,267	,08300

a. Einflußvariablen : (Konstante), loggdp, education, investment, rd, health

ANOVA[a]

Modell		Quadratsumme	df	Mittel der Quadrate	F	Sig.
1	Regression	,087	5	,017	2,528	,072[b]
	Nicht standardisierte Residuen	,110	16	,007		
	Gesamt	,197	21			

a. Abhängige Variable: deltay

b. Einflußvariablen : (Konstante), loggdp, education, investment, rd, health

Koeffizienten[a]

Modell		Nicht standardisierte Koeffizienten		Standardisierte Koeffizienten	T	Sig.	95,0% Konfidenzintervalle für B	
		Regressionskoeffizient B	Standardfehler	Beta			Untergrenze	Obergrenze
1	(Konstante)	,731	,408		1,791	,092	-,134	1,596
	health	,322	,104	1,334	3,093	,007	,101	,542
	investment	,004	,006	,202	,640	,531	-,008	,016
	rd	,504	,389	,387	1,297	,213	-,320	1,328
	education	-,035	,034	-,343	-1,036	,316	-,108	,037
	loggdp	-,586	,240	-1,303	-2,442	,027	-1,094	-,077

a. Abhängige Variable: deltay

Malaysia

Anmerkungen

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Deskriptive Statistiken

	Mittelwert	Standardabweichung	N
deltay	,0275	,05209	22
health	3,2545	,41142	22
investment	31,4182	9,85213	22
rd	,5170	,28808	22
education	5,4455	1,04584	22
loggdp	3,6871	,15876	22

Korrelationen

		deltay	health	investment	rd	education	loggdp
Korrelation nach Pearson	deltay	1,000	,339	-,288	,124	-,211	-,101
	health	,339	1,000	-,779	,893	,167	,713
	investment	-,288	-,779	1,000	-,835	-,306	-,547
	rd	,124	,893	-,835	1,000	,289	,842
	education	-,211	,167	-,306	,289	1,000	-,031
	loggdp	-,101	,713	-,547	,842	-,031	1,000
Sig. (1-seitig)	deltay	.	,061	,097	,291	,173	,327
	health	,061	.	,000	,000	,229	,000
	investment	,097	,000	.	,000	,083	,004
	rd	,291	,000	,000	.	,096	,000
	education	,173	,229	,083	,096	.	,446
	loggdp	,327	,000	,004	,000	,446	.
N	deltay	22	22	22	22	22	22
	health	22	22	22	22	22	22
	investment	22	22	22	22	22	22
	rd	22	22	22	22	22	22
	education	22	22	22	22	22	22
	loggdp	22	22	22	22	22	22

Aufgenommene/Entfernte Variablen[a]

Modell	Aufgenommene Variablen	Entfernte Variablen	Methode
1	loggdp, education, investment, health, rd[b]	.	Einschluß

a. Abhängige Variable: deltay

b. Alle gewünschten Variablen wurden eingegeben.

Modellzusammenfassung

Modell	R	R-Quadrat	Korrigiertes R-Quadrat	Standardfehler des Schätzers
1	,731[a]	,535	,389	,04071

a. Einflußvariablen : (Konstante), loggdp, education, investment, health, rd

ANOVA[a]

Modell		Quadratsumme	df	Mittel der Quadrate	F	Sig.
1	Regression	,030	5	,006	3,675	,021[b]
	Nicht standardisierte Residuen	,027	16	,002		
	Gesamt	,057	21			

a. Abhängige Variable: deltay

b. Einflußvariablen : (Konstante), loggdp, education, investment, health, rd

Koeffizienten[a]

Modell		Nicht standardisierte Koeffizienten		Standardisierte Koeffizienten	T	Sig.	95,0% Konfidenzintervalle für B	
		Regressionskoeffizient B	Standardfehler	Beta			Untergrenze	Obergrenze
1	(Konstante)	1,151	,580		1,985	,065	-,078	2,379
	health	,084	,052	,666	1,619	,125	-,026	,195
	investment	-,001	,002	-,101	-,273	,789	-,005	,004
	rd	,089	,150	,491	,590	,563	-,230	,408
	education	-,026	,011	-,528	-2,294	,036	-,051	-,002
	loggdp	-,348	,153	-1,061	-2,280	,037	-,672	-,024

a. Abhängige Variable: deltay

Philippines

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Deskriptive Statistiken

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deltaY	,0235	,04478	22
health	3,4841	,45654	22
investment	22,2000	3,66034	22
rd	,1291	,01411	22
education	2,9682	,37050	22
loggdp	3,0802	,13674	22

Korrelationen

		deltaY	health	investment	rd	education	loggdp
Korrelation nach Pearson	deltaY	1,000	,265	-,299	-,428	-,577	,099
	health	,265	1,000	-,501	-,849	-,341	,903
	investment	-,299	-,501	1,000	,688	,576	-,534
	rd	-,428	-,849	,688	1,000	,718	-,805
	education	-,577	-,341	,576	,718	1,000	-,296
	loggdp	,099	,903	-,534	-,805	-,296	1,000
Sig. (1-seitig)	deltaY	.	,116	,089	,024	,002	,331
	health	,116	.	,009	,000	,060	,000
	investment	,089	,009	.	,000	,003	,005
	rd	,024	,000	,000	.	,000	,000
	education	,002	,060	,003	,000	.	,091
	loggdp	,331	,000	,005	,000	,091	.
N	deltaY	22	22	22	22	22	22
	health	22	22	22	22	22	22
	investment	22	22	22	22	22	22
	rd	22	22	22	22	22	22
	education	22	22	22	22	22	22
	loggdp	22	22	22	22	22	22

Aufgenommene/Entfernte Variablen[a]

Modell	Aufgenommene Variablen	Entfernte Variablen	Methode
1	loggdp, education, investment, health, rd[b]	.	Einschluß

a. Abhängige Variable: deltaY

b. Alle gewünschten Variablen wurden eingegeben.

Modellzusammenfassung

Modell	R	R-Quadrat	Korrigiertes R-Quadrat	Standardfehler des Schätzers
1	,660[a]	,436	,260	,03853

a. Einflußvariablen : (Konstante), loggdp, education, investment, health, rd

ANOVA[a]

Modell		Quadratsumme	df	Mittel der Quadrate	F	Sig.
1	Regression	,018	5	,004	2,473	,077[b]
	Nicht standardisierte Residuen	,024	16	,001		
	Gesamt	,042	21			

a. Abhängige Variable: deltaY

b. Einflußvariablen : (Konstante), loggdp, education, investment, health, rd

Koeffizienten[a]

Modell		Nicht standardisierte Koeffizienten		Standardisierte Koeffizienten	T	Sig.	95,0% Konfidenzintervalle für B	
		Regressionskoeffizient B	Standardfehler	Beta			Untergrenze	Obergrenze
1	(Konstante)	,687	,582		1,181	,255	-,546	1,921
	health	,074	,057	,757	1,305	,210	-,046	,195
	investment	,000	,003	-,015	-,057	,955	-,007	,007
	rd	,107	2,492	,034	,043	,966	-5,177	5,391
	education	-,066	,051	-,549	-1,300	,212	-,175	,042
	loggdp	-,239	,157	-,728	-1,516	,149	-,572	,095

a. Abhängige Variable: deltaY

Singapore

Anmerkungen

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	Verwendete Fälle	Die Statistiken basieren auf Fällen, bei denen für keine verwendete Variable Werte fehlen.
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	Zusätzlich erforderlicher Speicherplatz für Diagramme von Residuen	0 Byte

Deskriptive Statistiken

	Mittelwert	Standardabweichung	N
deltaY	,0282	,03961	22
health	3,3000	,55720	22
investment	28,4136	6,17100	22
rd	1,8309	,42452	22
education	3,3591	,29222	22
loggdp	4,4069	,15410	22

Korrelationen

		deltaY	health	investment	rd	education	loggdp
Korrelation nach Pearson	deltaY	1,000	,362	-,315	-,050	-,022	-,135
	health	,362	1,000	-,571	,620	-,380	,747
	investment	-,315	-,571	1,000	-,770	-,380	-,497
	rd	-,050	,620	-,770	1,000	,019	,707
	education	-,022	-,380	-,380	,019	1,000	-,236
	loggdp	-,135	,747	-,497	,707	-,236	1,000
Sig. (1-seitig)	deltaY	.	,049	,077	,412	,462	,275
	health	,049	.	,003	,001	,040	,000
	investment	,077	,003	.	,000	,040	,009
	rd	,412	,001	,000	.	,466	,000
	education	,462	,040	,040	,466	.	,145
	loggdp	,275	,000	,009	,000	,145	.
N	deltaY	22	22	22	22	22	22
	health	22	22	22	22	22	22
	investment	22	22	22	22	22	22
	rd	22	22	22	22	22	22
	education	22	22	22	22	22	22
	loggdp	22	22	22	22	22	22

Aufgenommene/Entfernte Variablen[a]

Modell	Aufgenommene Variablen	Entfernte Variablen	Methode
1	loggdp, education, investment, rd, health[b]	.	Einschluß

a. Abhängige Variable: deltaY

b. Alle gewünschten Variablen wurden eingegeben.

Modellzusammenfassung

Modell	R	R-Quadrat	Korrigiertes R-Quadrat	Standardfehler des Schätzers
1	,800[a]	,640	,528	,02721

a. Einflußvariablen : (Konstante), loggdp, education, investment, rd, health

ANOVA[a]

Modell		Quadratsumme	df	Mittel der Quadrate	F	Sig.
1	Regression	,021	5	,004	5,700	,003[b]
	Nicht standardisierte Residuen	,012	16	,001		
	Gesamt	,033	21			

a. Abhängige Variable: deltaY

b. Einflußvariablen : (Konstante), loggdp, education, investment, rd, health

Koeffizienten[a]

Modell		Nicht standardisierte Koeffizienten		Standardisierte Koeffizienten	T	Sig.	95,0% Konfidenzintervalle für B	
		Regressionskoeffizient B	Standardfehler	Beta			Untergrenze	Obergrenze
1	(Konstante)	,956	,326		2,928	,010	,264	1,648
	health	,052	,025	,732	2,112	,051	,000	,104
	investment	-,005	,003	-,793	-1,978	,065	-,011	,000
	rd	-,059	,029	-,638	-2,048	,057	-,121	,002
	education	-,026	,038	-,191	-,677	,508	-,107	,055
	loggdp	-,172	,069	-,670	-2,509	,023	-,318	-,027

a. Abhängige Variable: deltaY

Thailand

Deskriptive Statistiken

	Mittelwert	Standardabweichung	N
deltaY	,0261	,05120	22
health	3,6136	,24745	22
investment	30,3091	8,41840	22
rd	,1895	,06729	22
education	4,0614	,78040	22
loggdp	3,4261	,15521	22

Korrelationen

		deltaY	health	investment	rd	education	loggdp
Korrelation nach Pearson	deltaY	1,000	-,333	-,138	,225	-,213	-,024
	health	-,333	1,000	-,302	,203	,338	,725
	investment	-,138	-,302	1,000	-,897	-,728	-,214
	rd	,225	,203	-,897	1,000	,662	,315
	education	-,213	,338	-,728	,662	1,000	,178
	loggdp	-,024	,725	-,214	,315	,178	1,000
Sig. (1-seitig)	deltaY	.	,065	,270	,157	,170	,458
	health	,065	.	,086	,182	,062	,000
	investment	,270	,086	.	,000	,000	,170
	rd	,157	,182	,000	.	,000	,076
	education	,170	,062	,000	,000	.	,214
	loggdp	,458	,000	,170	,076	,214	.
N	deltaY	22	22	22	22	22	22
	health	22	22	22	22	22	22
	investment	22	22	22	22	22	22
	rd	22	22	22	22	22	22
	education	22	22	22	22	22	22
	loggdp	22	22	22	22	22	22

Aufgenommene/Entfernte Variablen[a]

Modell	Aufgenommene Variablen	Entfernte Variablen	Methode
1	loggdp, education, rd, health, investment[b]	.	Einschluß

a. Abhängige Variable: deltaY

b. Alle gewünschten Variablen wurden eingegeben.

Modellzusammenfassung

Modell	R	R-Quadrat	Korrigiertes R-Quadrat	Standardfehler des Schätzers
1	,633[a]	,400	,213	,04543

a. Einflußvariablen : (Konstante), loggdp, education, rd, health, investment

ANOVA[a]

Modell		Quadratsumme	df	Mittel der Quadrate	F	Sig.
1	Regression	,022	5	,004	2,135	,114[b]
	Nicht standardisierte Residuen	,033	16	,002		
	Gesamt	,055	21			

a. Abhängige Variable: deltaY

b. Einflußvariablen : (Konstante), loggdp, education, rd, health, investment

Koeffizienten[a]

Modell		Nicht standardisierte Koeffizienten		Standardisierte Koeffizienten	T	Sig.	95,0% Konfidenzintervalle für B	
		RegressionskoeffizientB	Standardfehler	Beta			Untergrenze	Obergrenze
1	(Konstante)	,293	,267		1,098	,288	-,273	,859
	health	-,120	,074	-,579	-1,629	,123	-,276	,036
	investment	-,003	,003	-,513	-,934	,364	-,010	,004
	rd	,101	,418	,133	,243	,811	-,784	,986
	education	-,035	,019	-,539	-1,831	,086	-,076	,006
	loggdp	,112	,116	,340	,970	,347	-,133	,358

a. Abhängige Variable: deltaY